

a probable error of 1/1,000,000 to 1/1,500,000, take from two to six months to measure, and cost from 500*l.* to 2600*l.* The observations for the primary triangulation are made with an 8-inch direction theodolite, the average rate and cost being six stations per month and 3*s.* 7*d.* per square mile, and the average probable error of the triangulation 1/40,000. The averages of the Geodetic Survey are three-fourths of a station per month, from £2 to £6 per square mile and the probable error 1/150,000. For filling in the detail the essential instruments are the plane-table and telescopic alidade (p. 156). The horizontal distances are obtained, according to circumstances, by triangulation with the plane-table, by stadia and odometer measurements, by chaining, and by pacing. The altitudes are dependent upon primary lines of levels run with a precise spirit-level (p. 328), and having a probable error in feet = $\cdot 02 \sqrt{\text{distance in miles}}$; on angles of elevation and depression at the principal trigonometrical stations, on secondary lines of spirit-levels and on aneroid observations. The topographical features are represented on the map by contour lines sketched by eye with the assistance of an aneroid, and great importance is attached to the quality of the sketching. This depends upon the artistic and practical skill of the topographer, or upon his ability to make correct generalisations, and decide upon the amount of detail which should be omitted or preserved so as to bring out, on the selected scale, the predominant features of the country surveyed. In this work, as the author justly remarks, great proficiency "can only be attained after years of experience." He also rightly holds that the topographer should have a sufficient knowledge of geology and physiography, or of the "origin and development of topographic forms," to enable him to appreciate the features which he is sketching and to represent them intelligently on his sketch.

Mr. Wilson's book is, however, very far from being a simple manual for the use of the Geological Survey. It deals with every description of survey, and treats each fully. Part i. contains much useful information on the different classes of survey. An interesting description is given of the survey of Baltimore on a scale of 1:2400, which corresponds nearly to the 25-inch scale of the Ordnance Survey; but if the figures given in the table, p. 107 (Baltimore 814*l.* per square mile, Ordnance Survey 59*l.*), are correct, the cost would be considered prohibitive in this country. The remarks on geographic and exploratory surveys are good, and Mr. Johnson's excellent plane-table sketch, which is given as a specimen of an exploratory survey (p. 91), may well serve as a model for sketchers. Military surveys are correctly defined as having for their object "the representation of the natural and artificial features of the country with the maximum exactitude consistent with the greatest rapidity of execution." The concluding chapter is a well illustrated memoir on the relations of geology to topography, and on 'earth sculpture,' or the constructive and destructive processes by which existing topographical features have been formed. The importance of a knowledge of these subjects to the topographer and cartographer is clearly pointed out. A valuable addition to the chapter is a glossary of all geographical and topographical descriptive terms in common use in

the United States, which, pending the compilation of a similar list for the United Kingdom, will be found useful in this country.

In Part ii. the instruments and methods employed in the measurement of horizontal distances and in plane surveying are clearly described and explained. Chapters vii. and viii. on plane-tables and alidades, and chapters xii. and xiii. on stadia and angular tachymetry, deserve the attention of surveyors in England, where stadia measurements, which give results over rough ground as good as those with the chain, are little known. In another chapter the author describes photo-surveying methods, which are much in favour in Canada, and points out their limitations and the conditions under which they can be advantageously employed. Part iii. deals with instruments and methods for the determination of altitudes. The American spirit levels and levelling staves are of better pattern than those in use on our Ordnance Survey, and the accuracy of the principal lines of levels is greater than that of the similar lines in Great Britain. In Part iv. the author explains the various kinds of map projections, the methods of representing hill features and the construction of relief maps. He very rightly lays down that the cartographer should be "possessed of such actual knowledge of map-making as is only gained by practical experience in field-surveying," and that the topographer should have a general knowledge of projections and map construction. The difference between the principal methods of representing ground is well brought out; that by hachures is happily characterised as "a graphic system with a conventional element," and that by contours at close intervals as "a conventional system with a graphic element." Wax and clay mixed with glycerine are considered the best materials for modelling, and it is pointed out that a modeller should have a good knowledge of topography. Parts v. and vi., "Terrestrial Geodesy" and "Geodetic Astronomy," are clearly written and well supplied with tables; and the latter contains a chapter on "Photographic Longitudes." In Part vii. the surveyor in unsettled country will find many excellent hints as to camp stores and equipment, pack transport, medicines, clothing and photography.

In conclusion, it may be added that the book contains 884 pages, 62 tables of various kinds, 205 excellent illustrations, and a most useful index. It would in some respects have been more convenient if it had been published in two volumes. C. W. W.

THE ETHNOGRAPHY OF BRITISH COLUMBIA.

Memoirs of the American Museum of Natural History. Vol. II. *Anthropology.* i. *The Jesup North Pacific Expedition.* iv. *The Thompson Indians of British Columbia.* By James Teit. Edited by Franz Boas. (1900.)

IMPORTANT results were looked for from the Jesup North Pacific Expedition, and the realisation has not belied the expectation. Thanks to the intimate knowledge of Mr. James Teit of their language, customs and beliefs, we now have a remarkably detailed and complete description of the Upper and Lower Thompson

Indians, especially as this is supplemented by the valuable work done by Dr. G. M. Dawson, Dr. Franz Boas, Mr. C. Hill Tout, and others on these or allied tribes of British Columbia, under the auspices of the British Association for the Advancement of Science.

The Upper Thompson Indians live in the valley of the Thompson River, while the Lower Thompson Indians dwell on the Fraser River. They appear to have decreased to one-third since the advent of the white man in 1858. The birth-rate is about equal to the deaths, but there is great mortality among young children; at the present time the population in some places seems to be about stationary, or is slowly increasing. The Lower Thompson Indians are quieter and steadier than the people of the upper division, but are slower and less energetic; they are also better fishermen and more expert in handling canoes, while the Upper Thompson Indians are better horsemen.

In this copiously-illustrated memoir Mr. Teit has carefully described the handicrafts of the Thompson Indians. Most of their implements were made of stone, bone, wood, bark, skins, matting or basketry. Work in stone, bone and wood was done by the men, while the preparation of skins, matting and basketry work fell to the share of the women. There was a certain amount of division of labour, as workmen skilful in any particular line of work exchanged their manufactures for other commodities.

The various kinds of habitations and clothing and ornaments are fully described, and the changes that have ensued since 1858 are recorded. For example, beads and dyed porcupine quills were largely used for embroidery before that date; but these were soon replaced by embroidery done in silk thread, and most of the patterns wrought at the present day are copies of the white man's patterns. Full accounts are given of the arts, of subsistence, varieties and preparation of food, hunting, fishing and the like, as well as of travel, transportation, trade and warfare.

The games and pastimes of adults and children are carefully dealt with, and this account usefully supplements what has been previously recorded for similar tribes. It is a pity that the author describes as a "bull-roarer" quite another kind of toy, which Culin calls a buzz; the latter is an oblong or circular piece of thin wood, with two holes near the centre through which a string is passed. It is widely distributed among the Indians of North America, and, so far as is known, has little in common with the true bull-roarer. The smaller boys and girls play "cats' cradle," and we are told they make many forms such as the "beaver," "deer," "man stealing wood," &c. Fig. 270 illustrates two of these puzzles, one—"dressing a skin"—is very difficult to follow; the second—"pitching a tent"—is simpler, and, strangely enough, is precisely similar to the "fish-spear" string puzzle of the Torres Straits Islanders.

Very interesting and instructive are the accounts given of the social organisation and festivals of the people, and of the customs relating to birth, childhood, puberty, marriage and death. Their religion is fully dealt with, and it is worthy of note that no totemism is recorded for these people; but each individual has a guardian spirit,

which was acquired during the puberty ceremonials. Only a few shamans inherited their guardian spirits without such ceremony from their parents, who had been particularly powerful. The guardian spirits of these parents appeared to them, uncalled for, in dreams and visions. The moral code is excellent, and the young people are often admonished and advised. It is good to be pure, cleanly, honest, truthful, brave, friendly, hospitable, energetic, bold, virtuous, liberal, kind-hearted to friends, diligent, independent, modest, affable, social, charitable, religious or worshipful, warlike, honourable, stout-hearted, grateful, faithful and revengeful to enemies. Various legends are noted, and there are the usual constellation myths; but several of the stars or constellations have not been identified, so that no comparative study is possible. The traditions have been published in full by Mr. Teit in the *Memoirs of the American Folk-lore Society*, vol. iv.

The memoir concludes with a chapter on art and a summary, both by Dr. Boas. The decorative art of the Thompson Indian is very crude; form and decoration have no intimate connection, comparatively few designs are primarily decorative, their fundamental idea being symbolic. For this reason, by far the greater number of designs may be described as pictographs rather than as decorations.

The Thompson Indians are in appearance and culture a plateau tribe, influenced, however, to a great extent by their eastern neighbours, to a less extent by the tribes of the coast. Their whole social organisation is very simple, and the range of their religious ideas and rites is remarkably limited when compared with those of other American tribes. This may be one of the reasons why, in contact with other tribes, the Salish have always proved to be a receptive race, quick to adopt foreign modes of life and thought, and that their own influence has been comparatively small.

If all the field-work done by the numerous investigators on the staff of the Jesup North Pacific Expedition is as complete and workmanlike as the present memoir, and is published in similar first-class style, the result will be a dignified monument to the ability of American anthropologists and to the enlightened munificence of Dr. Jesup.

ALFRED C. HADDON.

OUR BOOK SHELF.

Lubrication and Lubricants. By L. Archbutt and R. M. Deeley. Pp. xxiv + 451. (London: C. Griffin and Co., Ltd., 1900.)

MESSRS. ARCHBUTT AND DEELEY have, in this treatise, placed before engineers and power users what is known of the theory and practise of lubrication.

Until the introduction of mineral oils as lubricants, there was comparatively little difficulty in obtaining good oils; the animal oils, such as sperm and lard, and the vegetable oils, such as castor, will keep a bearing cool, while mineral oils of the same apparent viscosity will allow it to heat. Oil users can only meet this difficulty by subjecting the oil to both chemical and mechanical tests.

The work is divided into two portions: the first treating of the theory of friction and the properties of lubricating substances, while the second describes the forms of bearings. The experiments of Mr. Beaucamp Towers and